WHAT IS CLAIMED IS:

1. A semiconductor device comprising:

a substrate;

an insulating film formed above the substrate and containing a metal, Si, N and O, the insulating film containing metal-N bonds larger than the sum total of metal-metal bonds and metal-Si bonds; and

an electrode formed above the insulating film.

2. The semiconductor device according to claim 1, wherein a content of the metal-N bonds in the insulating film is 1 atomic% or more.

3. The semiconductor device according to claim 1, wherein a content of the metal in the insulating film is 47 atomic% or more based on the total amount of the metal and Si.

4. The semiconductor device according to claim 1, wherein the metal contained in the insulating film comprises at least one selected from the group consisting of Zr, Hf and lanthanoide series metals.

5. The semiconductor device according to claim 4, wherein the metal is Hf, and the insulating film contains Si-O, Si-N, Hf-O and Hf-N bonds.

6. The semiconductor device according to claim 5, wherein the insulating film has the composition represented by formula below:

$$((SiO_2)_{1-x}(Si_3N_4)_x)_{1-z}((HfO_2)_{1-y}(HfN_\alpha)_y)_z$$

where $0<x, y, z<1$, $\alpha=4/3$

7. The semiconductor device according to claim 1, wherein the substrate has impurity diffusion regions separately formed and the insulating film is a gate insulating film formed between the impurity diffusion regions, and the electrode is a gate electrode.

8. A semiconductor device comprising:

a substrate;

an insulating film formed above the substrate and containing a metal, Si, N and O, the insulating film being amorphous and containing a metal-N bond; and

an electrode formed above the insulating film.

9. The semiconductor device according to claim 8, wherein a content of the metal-N bonds in the insulating film is 1 atomic% or more.

10. The semiconductor device according to claim 8, wherein the metal contained in the insulating film comprises at least one selected from the group consisting of Zr, Hf and lanthanoide series metals.

11. The semiconductor device according to claim 10, wherein the metal is Hf and the insulating film contains Si-O, Si-N, Hf-O, and Hf-N bonds.

12. The semiconductor device according to claim 11, wherein the insulating film has the composition represented by formula below:

$$((SiO_2)_{1-x}(Si_3N_4)_x)_{1-z}((HfO_2)_{1-y}(HfN_\alpha)_y)_z$$

where $0<x, y, z<1$, $\alpha=4/3$

13. A method for manufacturing a semiconductor

device comprising:

forming an insulating film containing a metal, Si, N and O, above a substrate by an off axis sputtering method, the insulating film containing metal-N bonds larger than the sum total of metal-metal bonds and metal-Si bonds; and

forming an electrode above the insulating film.

14. The method for manufacturing a semiconductor device according to claim 13, further comprising:

doping an impurity into the substrate, after forming the electrode, by using the electrode as a mask to form an impurity diffusion region.

15. A method for manufacturing a semiconductor device comprising:

forming a nitride film having a off-stoichiometric composition containing a metal and Si above a substrate by an off-axis sputtering method;

oxidizing the nitride film to form an insulating film containing metal-N bonds larger than the sum total of metal-metal bonds and metal-Si bonds; and

forming an electrode above the insulating film.

16. The method for manufacturing a semiconductor device according to claim 15, further comprising:

doping an impurity into the substrate, after forming the electrode, by using the electrode as a mask to form an impurity diffusion region.

17. A method for manufacturing a semiconductor

device comprising:

forming an oxide film having a off-stoichiometric composition containing a metal and Si above a substrate by an off-axis sputtering method;

nitriding the oxide film to form an insulating film containing metal-N bonds larger than the sum total of metal-metal bonds and metal-Si bonds; and

forming an electrode above the insulating film.

18. The method for manufacturing a semiconductor device according to claim 17, further comprising:

doping an impurity into the substrate, after forming the electrode, by using the electrode as a mask to form an impurity diffusion region.

19. A method for manufacturing a semiconductor device comprising:

forming a metal silicide film having a off-stoichiometric composition containing a metal and Si above a substrate by an off-axis sputtering method;

oxynitriding the metal silicide film to form an insulating film containing metal-N bonds larger than the sum total of metal-metal bonds and metal-Si bonds; and

forming an electrode on the insulating film.

20. The method for manufacturing a semiconductor device according to claim 19, further comprising:

doping an impurity into the substrate, after forming the electrode, by using the electrode as a mask

to form an impurity diffusion region.

21. A semiconductor device comprising:

a semiconductor substrate comprising a channel region;

an insulating film formed above the channel region of the semiconductor substrate and containing a metal, Si, N and O, the insulating film having a spectrum peak at a bonding energy of a metal-N bond;

a gate electrode formed above the semiconductor substrate; and

a pair of source/drain regions sandwiching the channel region of the semiconductor substrate.

22. The semiconductor device of claim 21, wherein the insulating film has no spectrum peak at a bonding energy of a metal-metal bond.

23. The semiconductor device of claim 21, wherein the insulating film has other spectrum peaks at binding energies of a metal-O bond, a Si-O bond and a Si-N bond, and the insulating film has no other spectrum peak(s) at a binding energy.